

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)  
LYNDON B. JOHNSON SPACE CENTER (JSC)**

**JUSTIFICATION FOR OTHER THAN FULL AND  
OPEN COMPETITION (JOFOC) OVER \$100,000  
PURSUANT TO 10 U.S.C. 2304(c)(1) and  
FEDERAL ACQUISITION REGULATION (FAR) 6.302-1**

**Exploration Flight Test 1 (EFT-1)**

**1. This document is a justification for other than full and open competition prepared by the NASA JSC.**

**2. The nature and/or description of the action being approved:**

NASA/JSC has a one-time requirement for critical performance data from an integrated flight test of the Orion spacecraft as part of the Orion Multipurpose Crew Vehicle (MPCV) Design, Development, Test, and Evaluation (DDT&E) phase.

The EFT-1 is an early flight test, required by early 2014, of the Orion spacecraft that is currently being developed by Lockheed Martin Space Systems Corporation (LMSSC), Denver, Colorado under contract NNJ06TA25C. The Orion spacecraft is a crew vehicle for missions beyond Low Earth Orbit (BEO) and will be launched on NASA's Space Launch System (SLS), which is expected to have a first flight in December 2017.

The EFT-1 flight test of the Orion spacecraft is required to facilitate earlier and more robust testing of critical Orion spacecraft systems that contribute to 10 of the 16 highest risks to crew survivability and exploration mission failure, including the parachutes, back shell and heat shield Thermal Protection Systems, Forward Bay Cover separation contact, and flight software. Executing this flight test in early 2014 is critical to ensure the flight test data is available for the Orion system Critical Design Review (CDR), which is to occur in April 2015. CDR is a critical DDT&E milestone, where the contractor discloses its complete spacecraft system design in full detail, identifying areas where technical problems and design anomalies have been resolved. Successful completion of CDR will validate that the contractor's spacecraft design maturity is at an acceptable level that justifies the decision to initiate fabrication/manufacturing, integration, and verification of flight hardware and software.

Executing the objectives of EFT-1 will support this CDR milestone through validation of the Orion spacecraft system design in a real flight environment, which cannot be duplicated through ground testing or simulation. This provides significant risk mitigation to NASA by providing an opportunity to identify technical problems and design anomalies on the contractor's spacecraft hardware and software design. EFT-1 data will also be utilized for nominal MPCV design optimization (mass reduction, structures updates, thermal protection system updates), environment updates (spacecraft loads and thermal), and model correlation for the Exploration Mission 1 (EM1) spacecraft. Conducting EFT-1 before CDR is required for the contractor to

make any required design changes and resolve technical problems and design anomalies discovered by the flight test in time to support the 2017 EM1 flight with the SLS.

NASA not executing EFT-1 would present significant additional technical, cost, and schedule risk in the event flight hardware or software problems are not discovered until after CDR, later in the qualification cycle. Depending on the failure, discovering and fixing hardware or software problems after CDR realistically could result in a year or more delay to the Orion DDT&E schedule. Resolution of these hardware or software problems after CDR would quite likely result in rework of critical design lifecycle processes, which would entail revising engineering, design drawings, manufacturing, testing, qualification, and delivery for incorporation into the spacecraft. This would not only impact the Orion schedule, but also that of the entire NASA Exploration Program, to include the SLS which together with Orion is required for the EM1. Such impacts would cause significant cost and schedule impacts to NASA. For example, a delay to the EM1 launch due to the Orion spacecraft not being ready on schedule would cause the SLS Program to incur additional sustaining engineering costs, as it must keep the launch vehicle in a ready and available state for launch. Conducting EFT-1 before the Orion CDR mitigates spacecraft DDT&E cost and schedule risks and enables the final Orion spacecraft design completion in time to support the EM1 scheduled to occur in December 2017 on the SLS.

Implementation of this contract action is proposed on a sole-source basis to LMSSC, Denver Colorado, via a modification to the Orion Contract, NNJ06TA25C.

### **3. Description of the supplies or services required, including the estimated value:**

NASA's primary requirement for this EFT-1 effort is for critical performance data of the Orion spacecraft from an integrated flight test. The data requirements are derived from NASA's stated EFT-1 flight test objectives. The EFT-1 flight test objectives are focused on demonstrating BEO spacecraft capabilities through an un-manned two orbit, high apogee high-energy entry flight test. The flight conditions required for EFT-1 were selected to demonstrate integrated vehicle performance for ascent, on-orbit flight, and a high-energy re-entry profile of approximately 30,280 feet per second from BEO. This trajectory will provide two orbital revolutions with an inertial entry interface velocity of nearly 84 percent of lunar re-entry velocity to stress the entry, descent, and landing functions, including the heat shield, propulsion, guidance/navigation/control, and parachute recovery systems. The flight test specifically will demonstrate critical system performance on 10 of the 16 highest loss of crew and loss of mission risks via high energy re-entry performance of the heatshield Thermal Protection System, Forward Bay Cover deployment and other critical separation events, drogue and main parachute deployment, crew module up-righting system deployment, and launch abort system jettison. Other objectives are for demonstration of on-orbit control via the power, guidance/navigation/control, and reaction control systems, along with the ground to spacecraft communications and tracking system. The EFT-1 test flight will incorporate specific elements and select system capabilities that will provide critical integrated vehicle data to the systems

designers that would otherwise not be available until the planned December 2017 fully integrated Orion flight with NASA's SLS.

To accomplish the EFT-1 objectives, NASA plans to add new requirements to the existing Orion Contract. The EFT-1 flight test utilizes an early production version of the Orion MPCV spacecraft, which is comprised of four elements: the Orion launch abort system, crew module, service module, and spacecraft adapter and fairings. The Orion contractor is currently developing these four elements under the existing Orion DDT&E contract. The Orion DDT&E contract was awarded in August 2006 and currently has an estimated contract value of \$6.4 billion.

The new requirement is for the contractor to develop and execute an end-to-end performance based EFT-1 solution as necessary to obtain the critical design data of the Orion MPCV spacecraft from this flight test. This includes development of a concept of operations and flight test approach that will be required to test, validate, and verify the contractor's spacecraft design against NASA's stated flight test objectives. The contractor will be required to integrate the Orion spacecraft with the launch system, along with other unique integration efforts between this integrated stack and the ground and operations systems. The additional requirements will necessitate the contractor providing the launch service, including a launch vehicle capable of lifting the spacecraft into a highly lofted orbit to achieve the high-energy reentry requirement. As a performance based contract, NASA is not dictating how the contractor performs the end-to-end EFT-1 effort, so long as the critical Orion data deliverable is available as required to support the Orion CDR. The primary deliverable for this effort will be the flight test data and engineering evaluation of the test results against the formal flight test objectives established by NASA. The estimated contract value adjustment required for the new EFT-1 requirements is \$375 million. The estimated period of performance required for this EFT-1 effort is within the existing Orion DDT&E contract period of performance.

#### **4. Statutory authority permitting other than full and open competition:**

10 U.S.C. 2304(c)(1), as implemented by FAR 6.302-1, Only One Responsible Source and no other source supplies or services will satisfy agency requirements.

#### **5. A demonstration that the proposed contractor's unique qualifications or the nature of the acquisition requires use of the authority cited:**

LMSSC is the only source that has the in-depth understanding of the Orion spacecraft which is necessary for the Government's technical and schedule requirements to obtain the Orion MPCV flight test data in a flight test in early 2014.

First, as the developer of the Orion spacecraft, LMSSC possesses the required technical understanding of the spacecraft design and its predicted responses in a dynamic coupled environment with a launch system. This knowledge is critical to understanding how both

vehicles must work in unison during the flight phases of launch, on-orbit maneuvering, and de-orbit return in order for the Orion spacecraft to accomplish and test the objectives of EFT-1. LMSSC is uniquely positioned to determine prelaunch predictions for integrated spacecraft/launch vehicle loads, thermal, flight control, and separation dynamics; and then deconstruct the post-flight data for quick application toward design/development updates to the Orion spacecraft that are required for the Orion CDR.

Second, LMSSC is the only contractor with the systems level knowledge of the Orion design necessary to perform the integrated systems analysis activity that will be required to integrate the spacecraft with the launch system to meet the EFT-1 objectives in time for the required early 2014 flight. These systems analyses and integration activities are needed to mate the Orion spacecraft with a launch system. Further, a detailed understanding of the unique Orion spacecraft interfaces and environmental drivers is required. Over the contract's period of performance, LMSSC has completed multiple design and analysis cycles which identified and mitigated unique launch vehicle to Orion integration challenges. Examples include: 1) resolution of a unique Orion outer mold line on a coupled-stack design environment; 2) mitigation of coupled Orion/launch vehicle control system interactions during flight; 3) optimization of unique Orion ground and flight interface designs between Orion, ground systems, and launch vehicle; and 4) integrated vehicle staging sequences and operational handoffs between the launch vehicle and Orion. This level of knowledge, specifically focused on the integration of the Orion spacecraft with a launch vehicle, gained over the 5-year period of performance under the Orion Contract could not be reasonably obtained by another contractor in time to meet the early 2014 launch date requirement.

Third, LMSSC has been intimately involved in developing the operational concepts, processing plans, and servicing requirements for the Orion spacecraft. Since the objectives of EFT-1 are to validate the driving design, interface, operational, processing, and servicing requirements that LMSSC has developed in its Orion spacecraft design, LMSSC is uniquely capable to determine the flight test approach to be used to obtain the validation and verification data from this flight test. This contracting approach of utilizing LMSSC for the DDT&E and integrated flight test enables NASA to accomplish the technical and schedule requirements for the EFT-1 objectives. Using another contractor unfamiliar with the Orion systems and designs will not meet NASA's required schedule for the data needed to support the Orion CDR.

#### **6. Description of the efforts made to ensure that offers are solicited from as many potential sources as practicable:**

In accordance with FAR 5.201, a synopsis was posted to the NASA Electronic Posting System on November 7, 2011. The synopsis closed on November 22, 2011. The synopsis identified LMSSC as the intended sole-source provider for the EFT-1 integrated flight test. The synopsis requested interested companies with the capability to meet the EFT-1 requirements to submit their capabilities and qualifications for NASA's consideration. Additionally, the synopsis stated

all responsible sources may submit an offer which shall be considered by NASA in accordance with FAR 6.302-1(d)(2).

**7. Description of the market survey conducted and the results, or a statement of the reasons a market survey was not conducted:**

A market survey of potential integrated flight test providers was conducted through research of available information and discussions with individuals within the Government who are knowledgeable in this market. Based on this market research, NASA determined that there were no firms that had the capability to conduct the EFT-1 within the required technical and schedule parameters necessary to meet NASA's requirements. NASA concluded that LMSSC, under the Orion Contract, is the only responsible source available to meet the requirements.

**8. Other facts supporting the use of other than full and open competition:**

In order to meet the early 2014 launch date requirement, LMSSC will be responsible for managing the interface requirements between the Orion spacecraft and its chosen launch provider as part of the end-to-end EFT-1 effort. Using LMSSC and its existing Orion interface design to affect any resultant design changes to integrate with a launch vehicle is critical to maintaining the required early 2014 launch date. Utilizing a contractor other than LMSSC for this interface management will not meet NASA's schedule requirement, as it would necessitate NASA managing the integration and analysis across a single hardware interface that would be shared by two independent contractors. This integration activity would take additional time and require additional layers of NASA personnel to manage interface control documents, to resolve differences between the interfaces, to provide oversight to the additional contractor's on-going and daily activities, and to provide other general contract surveillance and administration activities.

Finally, utilizing a contractor other than LMSSC to provide the integrated EFT-1 effort would present increased schedule risk to NASA's requirement to fly by early 2014, should anomalies, failures, or changes by a contractor working on one side of the interface impact a change to the contractor working on the other side of the interface. Any change from one side of the interface that impacts the other side of the interface would require a NASA directed change since NASA would be responsible for the interface requirement document. This would cause delay to the EFT-1 schedule and result in not meeting the early 2014 launch date requirement. Requiring a single contractor to be responsible for this interface development, and any necessary changes thereto, eliminates this schedule risk, associated cost, and potential disputes between contractors that would result from the predictable design evolution of the interface.

**9. A listing of sources, if any, that expressed in writing an interest in the acquisition:**

As stated in item 6 above, a synopsis was posted to NASA's Electronic Posting System. This notice requested potential sources to submit their capabilities and qualifications. Written

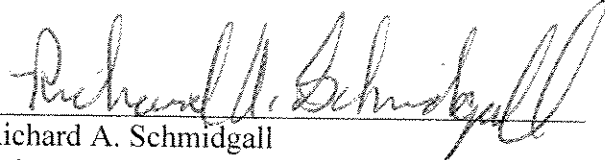
responses were received by NASA on November 22, 2011, from The Boeing Company and Space Exploration Technologies. NASA engaged in a detailed analysis and evaluation of both companies' responses to determine if they have the capabilities to meet NASA's requirements.

Both companies proposed capabilities which focused primarily on meeting one aspect of the requirement of NASA's end-to-end EFT-1 effort. This capability proposed by the companies was a launch vehicle. However, neither company addressed the complete requirements for the end-to-end EFT-1 effort. As stated previously, NASA's acquisition approach for EFT-1 is to procure an end-to-end, performance based solution for critical design data of the Orion MPCV spacecraft. As a performance based contract, NASA is not dictating how the contractor performs the end-to-end EFT-1 effort, so long as the critical Orion data deliverable is available as is required to support the Orion CDR. Providing a launch vehicle is simply a means to an end, and by itself, does not demonstrate capabilities that would enable either company to be in a position to determine how the Orion spacecraft needs to perform in orbit as required to accomplish the Orion EFT-1 flight test objectives. The Government will notify both companies via letter of this decision.

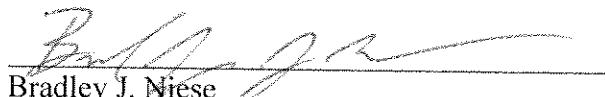
**10. A statement of the actions, if any, the Agency may take to remove or overcome any barriers to competition before any subsequent acquisition for the supplies or services required:**

This action is required to support execution of the flight test objectives for this one-time end-to-end EFT-1 effort. There is not an expected recurring need subsequent to this action for the requirements as described in section 3 of this document.

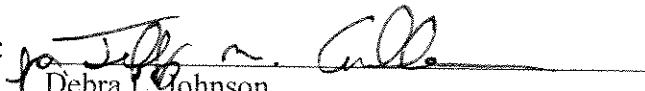
Technical Officer: I certify that the supporting data presented in this justification are accurate and complete.

  
Richard A. Schmidgall  
Orion Program Assistant Manager & Contracting Officer's Technical Representative  
Date 12/8/11

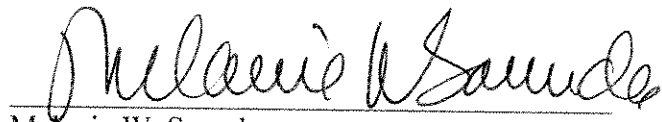
Contracting Officer: I hereby determine that the anticipated cost to the Government will be fair and reasonable and certify that this justification is accurate and complete to the best of my knowledge and belief.

  
Bradley J. Niese  
Contracting Officer  
Date 12/8/11


CONCURRENCE:

  
Debra L. Johnson  
Procurement Officer  
Date 12/9/11

CONCURRENCE:

  
Melanie W. Saunders  
Center Competition Advocate  
Date 12/9/11

CONCURRENCE:

  
William H. Gerstenmaier  
Head of the Contracting Activity  
Date 13 Dec 2011

CONCURRENCE:

  
Sheryl J. Goddard  
NASA Competition Advocate  
Date 14 Dec 2011

APPROVAL:

  
for William P. McNally  
Assistant Administrator for Procurement  
Date 14 Dec 2011